

Spin-dipole strengths and tensor correlation effects for $^{208}\text{Pb}(p, n)$ at 295 MeV

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We performed the multipole decomposition analysis (MDA) for the $^{208}\text{Pb}(p, n)$ data in order to obtain the spin-dipole (SD) strengths separated into each ΔJ^π contribution $dB(\text{SD}_{\Delta J^\pi}; \omega)/d\omega$. In the standard MDA [1], the experimentally obtained angular distributions $\sigma^{\text{exp}}(\theta, \omega)$ of the cross section are fitted using the least-squares method using the following linear combination of the calculated angular distributions $\sigma^{\text{calc}}(\theta, \omega)$ for various spin-parity transfers ΔJ^π 's:

$$\sigma^{\text{exp}}(\theta, \omega) = \sum_{\Delta J^\pi} a_{\Delta J^\pi} \sigma_{\Delta J^\pi}^{\text{calc}}(\theta, \omega), \quad (1)$$

where $a_{\Delta J^\pi}$ are the fitting coefficients and the $\sigma^{\text{calc}}(\theta, \omega)$ values are obtained using distorted wave impulse approximation (DWIA) calculations. In the present MDA, the polarization observable $D^{\text{calc}}(\theta, \omega)$, which are sensitive to ΔJ^π [2], are also evaluated with the DWIA results $D_{\Delta J^\pi}^{\text{calc}}(\theta, \omega)$ for the relevant observable by weighting each ΔJ^π contribution $a_{\Delta J^\pi} \sigma_{\Delta J^\pi}^{\text{calc}}(\theta, \omega)$:

$$D^{\text{calc}}(\theta, \omega) = \frac{\sum_{\Delta J^\pi} a_{\Delta J^\pi} \sigma_{\Delta J^\pi}^{\text{calc}}(\theta, \omega) D_{\Delta J^\pi}^{\text{calc}}(\theta, \omega)}{\sum_{\Delta J^\pi} a_{\Delta J^\pi} \sigma_{\Delta J^\pi}^{\text{calc}}(\theta, \omega)}. \quad (2)$$

The experimental polarization observables $D^{\text{exp}}(\theta, \omega)$ are also fitted with $D_{\Delta J^\pi}^{\text{calc}}(\theta, \omega)$. Thus the variable $a_{\Delta J^\pi}$ are determined using the least-squares technique to reproduce the cross section and polarization observable data simultaneously.

The SD strength is obtained by assuming a proportionality relation [3]. The proportionality relation between $dB(\text{SD}_{\Delta J^\pi}; \omega)/d\omega$ and the relevant cross section, $d^2\sigma_{\Delta J^\pi}(q, \omega)/d\Omega d\omega$, is given by $d^2\sigma_{\Delta J^\pi}(q, \omega)/d\Omega d\omega = \hat{\sigma}_{\text{SD}; \Delta J^\pi}(q, \omega) dB(\text{SD}_{\Delta J^\pi}; \omega)/d\omega$ where $\hat{\sigma}_{\text{SD}; \Delta J^\pi}(q, \omega)$ is the SD cross section per unit SD strength for spin-parity transfer ΔJ^π and depends on both the momentum transfer q and the energy transfer ω . The $d^2\sigma_{\Delta J^\pi}(q, \omega)/d\Omega d\omega$ data were taken from the MDA result at 4.0° where the SD transitions are predominantly excited. The $\hat{\sigma}_{\text{SD}; \Delta J^\pi}(q, \omega)$ values were obtained using the DWIA calculations. Their uncertainties have been investigated by evaluating these values in DWIA calculations employing different optical potential parameters and random phase approximation (RPA) response functions with different Landau-Migdal parameters of $g'_{NN}=0.60\pm 0.10$ and $g'_{N\Delta}=0.35\pm 0.16$ [1]. The uncertainties depend on ΔJ^π , and they are about 9%, 15%, and 11% for the 0^- , 1^- , and 2^- transitions, respectively.

Figure 1 shows the preliminary results for the SD strength distributions obtained in the present analysis. The lower three panels are the results of each SD strength $dB(\text{SD}_{\Delta J^\pi}; \omega)/d\omega$ for $\Delta J^\pi=0^-$, 1^- , and 2^- , and the top panel represents the total SD strength by summing up these three strengths. The solid curves in Fig. 1 are the RPA predictions with $g'_{NN}=0.60$ and $g'_{N\Delta}=0.35$ [1]. The calculations reproduce the total SD strength reasonably well, whereas some discrepancies are found for separated SD strength. The centroids of the resonances are slightly lower and higher than the theoretical predictions for 1^- and 2^- , respectively. These softening and hardening effects observed in 1^- and 2^- distributions would be due to the tensor correlation effects [4] not included in the present RPA calculations.

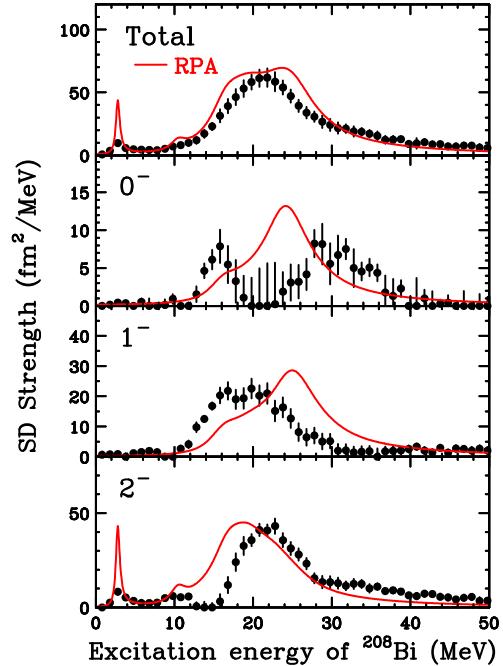


Figure 1: Spin-dipole strength distributions for $^{208}\text{Pb}(p, n)$.

References

- [1] M. Ichimura, H. Sakai, and T. Wakasa, Prog. Part. Nucl. Phys. **56**, 446 (2006).
- [2] J. M. Moss, Phys. Rev. C **26**, 727 (1982).
- [3] V. F. Dmitriev, V. Zelevinsky, and S. M. Austin, Phys. Rev. C **65**, 015803 (2001).
- [4] H. Sagawa, private communication.